

CLAIMS

What is claimed is:

1. An apparatus for introducing deadspace into a breathing circuit, comprising:
a deadspace portion of the breathing circuit located to receive gases exhaled by a patient upon positioning the breathing circuit in communication with an airway of the patient;
a primary expiratory pathway through the breathing circuit;
a flow restrictor positioned along said primary expiratory pathway downstream from a junction of said deadspace portion with said primary expiratory pathway; and
a two-way valve positioned along or at an end of said deadspace portion, said two-way valve having:
a first, closed position for causing exhaled gases to flow through said flow restrictor; and
a second, opened position for causing at least a portion of exhaled gases to flow into said deadspace portion.
2. The apparatus of claim 1, wherein said deadspace portion comprises at least a volume-adjustable section.
3. The apparatus of claim 2, wherein said volume-adjustable section is length expandable and length contractible.
4. A method for estimating the partial pressure of carbon dioxide in alveolar blood (PACO_2) of an individual, comprising:
calculating a concentration of carbon dioxide in the parallel deadspace (PDS_{CO_2}) of an airway of the individual; and
determining an end tidal partial pressure of carbon dioxide (etCO_2) of the individual.
5. The method of claim 4, further comprising determining a perfusion ratio (r).

6. The method of claim 5, wherein:

$$PACO_2 = [etCO_2 - (1 - r) \times PDS_{CO_2}] / r.$$

7. The method of claim 4, wherein said calculating comprises calculating said concentration of carbon dioxide in the parallel deadspace of the individual on a breath-by-breath basis.

8. The method of claim 4, wherein said calculating comprises:
determining a mixed inspired volume of carbon dioxide ($ViCO_2$) inhaled by the individual;
at least estimating an airway deadspace of the individual;
determining a partial pressure of end tidal carbon dioxide ($etCO_2$) of a previous breath of the individual; and
determining a tidal volume (V_t) of the individual's breathing.

9. The method of claim 8, wherein said calculating further comprises:
at least estimating a functional residual capacity (FRC) of alveoli of lungs of the individual.

10. The method of claim 9, wherein

$$PDS_{CO_2}(n) = \{[FRC/(FRC + V_t)] \times PDS_{CO_2}(n-1)\} + \\ ([ViCO_2 + (deadspace \times etCO_2(n-1))]/V_t) \times [V_t/(V_t + FRC)],$$

where (n) indicates a parameter for a current breath and (n-1) represents a parameter for an immediately preceding breath.